A Study of Optimization Techniques Based on Dynamic Programming

Student: **Ms. Na-Imah Jones**, *Junior in Electrical Engineering*

Advisor: **Dr. Kamal Fernando,** *Associate Professor, Engineering and Computer Science Division*

ABSTRACT

The goals of this project are to design a **C/*C++* *Object Oriented*** program to implement two numerical techniques used in dynamic programming for optimization:

- **The method of Steepest Gradient** (based on the first order term in the Tailor's series)
- **The Newton-Raphson method** (based on the second order term in the Tailor's series)

There are two objectives for the first phase of this project:

1. To select an efficient numerical integration technique to use in the optimizing algorithms.
2. To adapt the code generated by implementing the Steepest Gradient algorithm to solve special types of problems encountered in determining the optimal control for a control system.

In the second phase of this project, the two numerical techniques, based on the ***Steepest Gradient method*** and the ***Newton-Raphson method***, will be used to compare the two techniques in terms of performance for selected test problems such as:

- Finding the optimum throttle conditions to send a space vehicle to a low-earth orbit, while minimizing the mass of fuel usage.
- Modeling the Wright Flyer performance with enhanced stability control.
- Finding the optimum trajectory to send a spacecraft from the earth's-orbit to mars- orbit, while spending a minimum fuel usage.
- Finding the optimal trajectory and conditions to bring a space vehicle from the earth's orbit to its surface with the minimum heat generation.